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(54) **A self-checkout system**

(57) An article checkout system incorporates two weighing scales 16,20 aside a checkout counter 10 having a UPC scanner 12. As an article is taken from the shopping cart on the in-scanner scale, the system makes an immediate determination of the decrement weight associated with such article removal. Upon scanning the article UPC and obtaining its weight from computer store 24, the system compares the decrement weight with the computer-provided weight. Should there be any discrepancy between the compared weights, it is detected by the system at the close of the scan and prior even to movement of the article to the shopping cart on the out-scanner scale, activates a monitor unit 44 to alert staff or activate monitor 14 at the checkout counter. A video recording is thus made of the events following close of scan and entry of the article into the shopping cart on the out-scanner scale. A second level comparison is also made between the combined weight in scale 16 and the weight of an article on the counter as determined by its UPC code and the weight in the out scale 20. Discrepancies activate a further alarm.
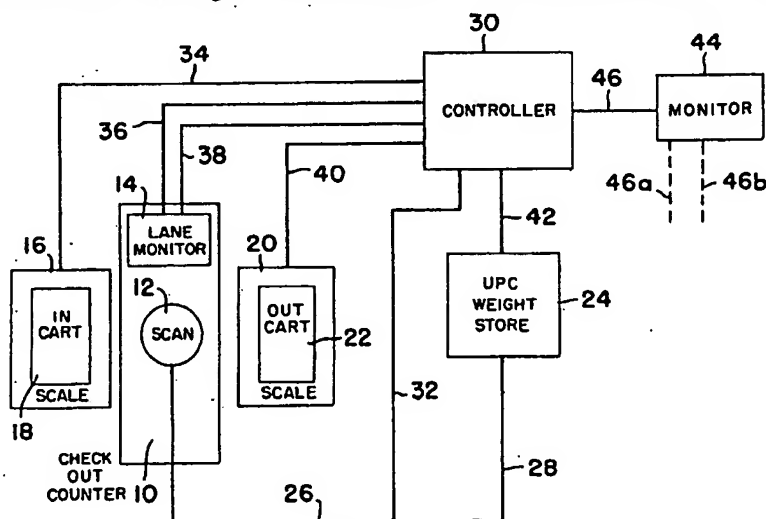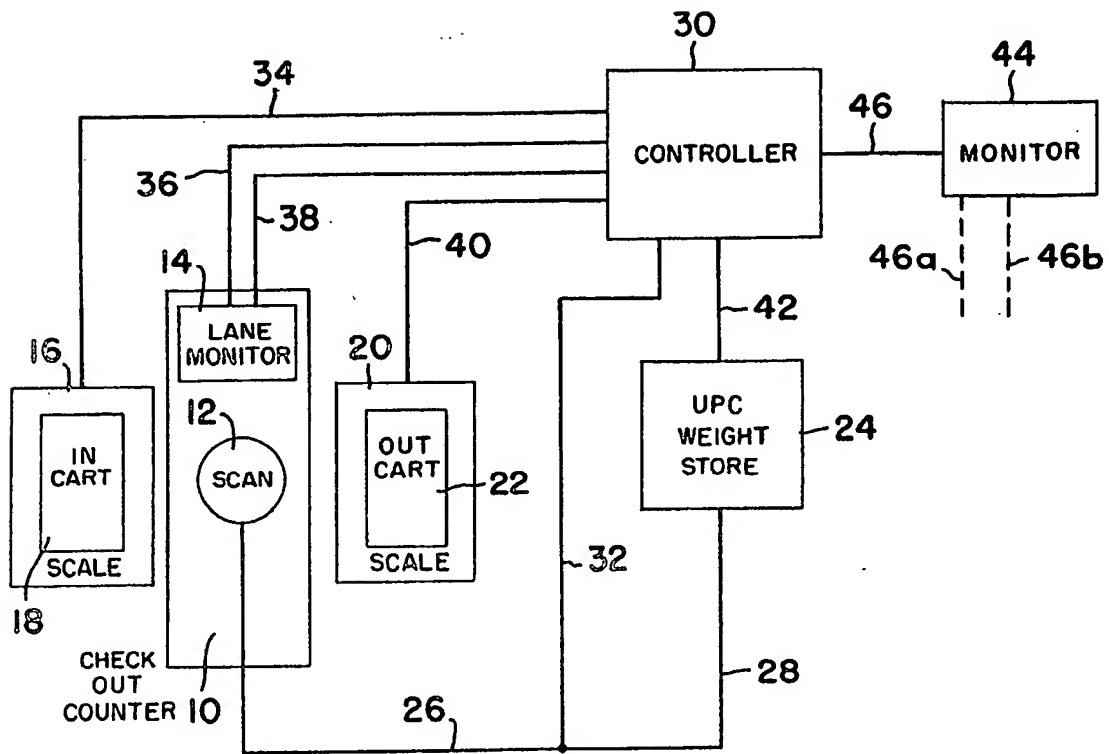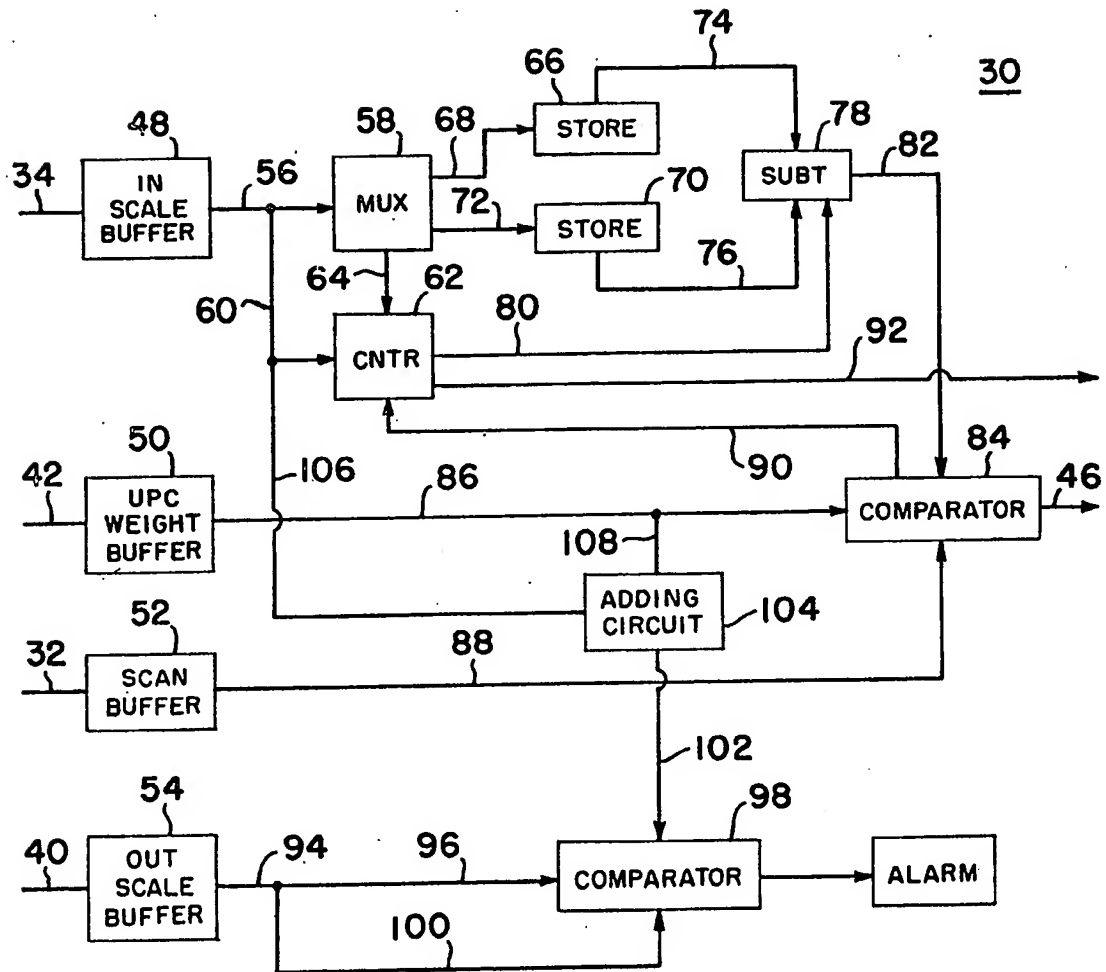
FIG. 1

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*FIG. 1*

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FIG. 2

SPECIFICATION

## A self-checkout system

5 The present invention relates generally to pro-
duct checkout and pertains more particularly
to systems for generally operator-unattended
checkout of products in supermarkets and like
facilities.
10   Operator-unattended product checkout in
supermarkets has evident advantages in les-
sening overhead employee costs and, to the
extent that such relatively automated checkout
can be made expeditious, in conserving the
15 time a customer will spend in the course of
checkout.
   The art has looked over the past decades
to improved systems and methods for lessen-
ing the need for employee involvement in pro-
20 duct checkout. A principal endeavour in this
connection has been to provide a scheme
which is operative, despite human frailties of
fraud, i.e., cheating the system in place. As is
evident from the state of the art numerous
25 efforts of an anti-fraud or anti-cheat character
have previously been proposed.
   A primary direction followed in the prior art
is that of measuring a physical characteristic
of articles selected for purchase, typically the
30 individual or collective weight thereof, and
comparing such measured characteristic with
an expected standard therefore. In one prior
art teaching, weight is measured collectively of
articles selected for purchase after individual
35 processing thereof with article indentification.
In a more modern prior art implementation,
product identification is provided by sensible
codes thereon. A computer stores provides
indication of article weight responsively to the
40 sensing of the code thereon. Comparison is
made of actual article measured weight in the
course of conveyor movement thereof with
the weight provided by the computer store. If
the comparison does not yield a positive re-
45 sult, conveyor movement is reversed and the
conveyorized product is returned to the cus-
tomer.
   In other systems which we have previously
proposed, various provisions of security nature
50 are implemented, for example, the providing of
a security tunnel into which articles are placed
for measurement of article characteristics for
comparative purpose. Beyond article weight
observance and comparison, such commonly-
55 owned systems look to shape indentification
and redundant sensing of article code within
the security tunnel. In such systems, shape
observance may be effected by the light cur-
tain covering the entry to the security tunnel.
60 Information to be stored in respect of article
identification code, weight and shape may in-
deed be derived in the commonly-owned sys-
tems from the scanning unit, weight scale and
shape sensing devices.
65   In a further prior art approach, implemented

commercially in the Reams stores in the state
of Utah but not known to have been disclosed
in a Patent Specification, a checkout area is
provided with a counter which has in-floor
70 weighing scales on each of its opposite sides.
The customer moves a shopping cart contain-
ing articles selected for purchase onto one of
the scales, which will be termed the in-scan-
ner scale. An empty shopping cart is placed
75 on the other scale, which will be termed the
out-scanner scale. Between the weighing
scales, the counter includes a UPC (universal
product code) scanner. The customer mover
articles individually from the shopping cart on
80 the in-scanner scale, over the scanner and into
the shopping cart on the out-scanner. It is
believed that this system operates by obtain-
ing the scanned article weight from a UPC-
weight correlation table in a computer and us-
85 ing this computer weight to determine
whether, for a en article scanned and moved
into the cart on the out-scanner scale, one
scale show a decrement in collective article
weight and the other an increment in collec-
90 tive article weight corresponding to the com-
puter weight.
   While the systems and methods disclosed
in our first specification are deemed to be
quite effective in addressing the aforemen-
95 tioned human fraud frailties, they are relatively
complex and costly, and may be inapplicable
for reasons of economy in certain installations.
The plural weighing scale approach is seen as
providing a simpler and less costly method for
100 use in such facilities for generally operator-
unattended checkout or articles selected for
purchase in supermarkets and like facilities.
However, there is a need for a simpler and
less costly method to provide enhanced pro-
105 tection for store managers and parent organi-
zations.
   Accordingly, it is an object of the present
invention to provide an improved and generally
simpler operator-unattended checkout system
110 and method.
   It is a further object of the invention to ef-
fect selective and effective anti-fraud monitor-
ing of plural weighing scale type article check-
out systems.
115   With a view to achieving one or both of the
above objects, the invention provides an arti-
cle checkout systems incorporating plural
weighing scales aside a checkout counter hav-
ing a UPC scanner. As an article is taken from
120 the shopping cart on the in-scanner scale, the
system of the invention makes an immediate
determination of the decrement weight associ-
ated with such article removal. Upon scanning
of the article UPC and obtaining of its weight
125 from computer store, the system compares
the decrement weight with the computer-pro-
vided weight.
   Should there be a discrepancy between the
compared weights, it is detected by the sys-
130 tem of the invention at the close of the scan

and prior even to movement of the article to
the shopping cart on the out-scanner scale. A
signal is generated upon each such discre-
pancy detection and the invention contem-
5 plates use of these signals ·to prompt store
personnel intevention by way of at least the
monitoring of the checkout lane involved. Pre-
ferably, the system includes a monitor unit at
the checkout counter, which is activated at
10 the close of article scan on such discrepancy
signal generation. A video recording is thus
made of the events following close of scan
and entry of the article into the shopping cart
on the out-scanner scale.

15 Since the above-discussed discrepancy may
be found later not to be of fraudulent charac-
ter, as is discussed in detail below, the
method and system of the invention provide a
feature that may be regarded as an "insurance
20 recording" or a pre-awareness of a possibly
fraudulent event, which may have manifest
value in confronting the cheating customer
with the evidence, should the discrepancy
·have been fraudulent.

25 The present invention will be described in
greater detail by way of examples with refer-
ence to the accompanying drawings,
wherein:−

*Figure 1* is a general block diagram of one
30 preferred form of system for the self-checkout
of articles: and

*Figure 2* is a detailed block diagram of an
implementation of the Fig. 1. system.

Referring to Fig. 1, checkout counter 10 in-
35 cludes scan unit 12, which may be customary
UPC sscanner, and lane monitor 14, which
may be a video recorder and camera. To the
left side of counter 10 is a floor-installed
weighing scale 16 (in-scanner scale), on which
40 is situated shopping cart 18 containing the
articles selected for purchase by a customer.·
To the right side of counter 10 is another
floor-installed weighing scale 20 (out-scanner
scale), on which is situated shopping cart 22,
45 initially empty, but intended to receive articles
seriatim from cart 18 after scanning by scan
unit 12.

Scan unit 12 is connected to UPC weight
store 24 by lines 26 and 28 and to controller
50 30 by lines 26 and: 32. Scale 16 is connected
by line 34 to controller 30. Lane monitor 14
is connected to controller 30 by lines 36 and
38. Scale 20 is connected to controller 30 by
line 40. Other system connections are, UPC
55 weight store 24 by line 42 to controller 30,
and controller 30 to store monitor 44 by line
46. The system of Fig. 1 is intended for use
with a single lane checkout counter, but may
operate with other lanes, shown tied in by
60 phantom lines 46a and 46b with store moni-
tor 44.

Operation of the Fig. 1 system will be bet-
ter understood by considering the particular
implementation of controller 30 shown in Fig.
65 2. ·

In Fig. 2, controller 30 is configured with
input buffers 48 (in scale buffer) receiving and
storing the line 34 signal, 50 (UPC weight
buffer) receiving and storing the line 42 signal,
70 52 (scan buffer) receiving and storing the line
32 signal and 54 (out scale buffer) receiving
and storing the line 40 signal.

It will be helpful initially to consider a proper
series of activities at the checkout counter,
75 i.e., wherein a customer removes articles indi-
vidually from cart 18, scans the code
thereof, and· places same in the out cart 22,
all before removing another article from cart
18. The initial output of scale 16, prior to first
80 article removal from cart 18 is in buffer 48
and is applied to line 56 and hence to multi-
plexer 58. Since line 60 is stable, not under-
going change, counter 62 is at zero count and
so informs multiplexer 58 over line 64a. The
85 multiplexer is accordingly operative to furnish
buffer 48 content to store 66 over line 68.

Upon removal of an article from cart 18,
line 34 changes its voltage reading .based on
the change in the output of scale 16. Line 56
90 applies the output of the in scale buffer 48,
indicative of the initial cart 18 weight decre-
mented· by the weight of the removed article
to multiplexer 58 and also over line 60 to
counter 62. The counter, based on the change
95 in the line 56 signal, advances to first count,
which is provided over line 64b to multiplexer
58. The signal output of buffer 48 is there-
upon applied selectively to store 70 over mul-
tiplexer output line 72.

100 The contents of stores 66 and 70 are ap-
plied by lines 74 and 76 to sbubtraction cir-
cuit 78. First count indication is applied over
line 80 to circuit 78, whereupon a signal in-
dicative of the difference in weight contents of
105 stores 66 and 70 is applied to line 82 and
thereby to comparator 84, a second input to
. which is provided over. line 86 from UPC
weight buffer 50. Upon scanning and suitable
delay to permit line 86 data in stable form,
110 line 88 is activated to cause comparator to
make the comparison of its inputs from lines
82 and 86. If this comparison is positive, indi-
cating a correspondence of the weight indica-
tions of the two input signals, counter 62 is
115 reset to zero by signal from comparator 84
over line 90. Comparator output line 46 is not
activated, since checkout events comport with
those desired by the system.

In the event that the customer were to have
120 removed not one but two articles simultane-
ously from cart 16, comparator 84 would then
find non-correspondence as between its input
signals on lines 82 and 86, the former ex-
ceeding the latter, and would activate line 46,
125 either to alert store personnel, or to activate
monitor 14, or both. Such line 46 signal can
also be used to reset counter 62 to zero.

Likewise, in the event that the customer re-
moves a second article from cart 18 prior to
130 validation of the first article transaction by

comparator 84, counter 62 will be stepped to
its second count, based on the accompanying
disturbance of lines 34, 56 and 60. Counter
62 provides output on line 92 indicative of its
5 having reached second count and such line 92
signal is used alternatively to the line 46 sig-
nal to alert store personnel or to activate
monitor 14, or both.
   The second level comparison, as between
10 scale 16 and UPC weight, on the one hand,
and scale 20, on the other hand, may also be
implemented in controller 30. Here, as the in-
dividual removed article is transferred, after
scanning, to cart 22, a change occurs on line
15 40 and also at the output line 94 of buffer
54. Line 96 conveys the weight reading of
buffer 54 to comparator 98 and line 100 con-
veys the change indication to comparator 98,
which accordingly compares the lines 96 read-
20 ing to the sum of the contents of buffer 48
(in scale) and buffer 50 (UPC weight), as pro-
vided on line 102 from adding circuit 104,
inputs to which are furnished by lines 106 and
108.
25   Where the comparison effected in compara-
tor 98 is not positive, the comparator acti-
vates its output line 110 and hence alarm unit
112.
   Various changes to the embodiments parti-
30 cularly described and shown and modifications
to the practice disclosed may be introduced
without departing from the scope of the in-
vention as defined in the claims.

35 CLAIMS
   1. A system for the checkout of articles
bearing sensible code indicative thereof and
selected for purchase, including:
   (a) means for containing said articles se-
40 lected for purchase and permitting withdrawal
thereof for processing;
   (b) first scale means for measuring the
weight of articles resident in said containing
means and providing an output signal indica-
45 tive of such measured weight;
   (c) scanner means for sensing such article
code and generating an output signal indica-
tive thereof;
   (d) storage means for storing article weight
50 information in correlation with article code and
responsive to said scanning means output sig-
nal for providing an output signal indicative of
such stored article weight;
   (e) means for receipt and containment of
55 articles following such scanning of said codes
thereof;
   (f) second scale means for measuring the
weight of articles resident in said receiving
and providing an output signal indicative of
60 such measured weight;
   (g) controller means for comparing said out-
put signals of said first scale means and said
storage means and generating a first output
signal on failure of such comparison, and for
65 comparing said output signals of said first

scale means, said storage means and said
second scale means a second output signal
on failure of such comparison;
   (h) recorder means for recording events at
70 said checkout counter upon occurrence of said
first output signal; and
   (i) means for generating an output alarm sig-
nal upon occurrence of said second output
signal.
75   2. A system according to claim 1, wherein
said containing and receiving means comprise
respective first and second shopping carts and
wherein said means (b) first and second scale
means comprise respective first and second
80 scales upon which said shopping carts can be
separately situated.
   3. A system according to claim 1 or 2,
including a checkout counter supporting said
scanning means and said recorder means ther-
85 eon.
   4. A system according to claim 3, wherein
said first and second scales are situated in a
floor oppositely aside said checkout counter.
   5. A system according to any one of the
90 preceding claims, wherein said recorder means
comprises a video recorder.
   6. A system according to any one of the
preceding claims, wherein said controller
means comprises a counter monitoring said
95 output signals of said first means and stepped
upon change therein, plural storage units, a
multiplexer responsive to said counter to gate
said first scale means output signals selec-
tively to said plural storage units, signal sub-
100 traction circuitry connected to said storage
storage units and responsive to said counter
to provide an output signal indicative of such
subtraction, and a comparator receiving such
subtraction circuitry output signal and said
105 output signal of said storage means and pro-
viding said controller second output signal.
   7. A system according to claim 8, wherein
said counter is operative further for itself initi-
ating operation of said recorder means.
110   8. A system for the checkout of articles
bearing sensible code indicative thereof and
selected for purchase, constructed substan-
tially as herein described with reference to and
as illustrated in the accompanying drawings.